

Notice of Allowability

Application No.

10/017,158

Examiner

Jason M. Perilla

Applicant(s)

NIELSEN, JORGEN S.

Art Unit

2638

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment filed July 20, 2005.
2. ☒ The allowed claim(s) is/are claims 1-10, 13, and 21-29 renumbered respectively as claims 1-20.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 20050927.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. Claims 1-13, 16, and 21-29 are pending in the instant application.
2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Joseph M. Sauer on September 27, 2005.

The application has been amended as follows wherein claims 11, 12, and 16 have been cancelled, and the following versions of claims 1, 7, 8, 9, 10, 12, 13, 21-23 and 29 replace all prior versions in their entirety:

1. An Adaptive Generalized Matched Filter (AGMF) rake receiver system, comprising:
 - a rake receiver coupled to a spread spectrum input signal that applies a vector of weight signals (\vec{w}) to the spread spectrum input signal to compensate for dependant noise and generates a decision variable; and
 - an AGMF weight determination module that monitors the decision variable and generates the vector of weight signals, wherein optimal values for the vector of weight signals (\vec{w}) are calculated by the AGMF weight determination module by varying the vector of weight signals until a signal-to-noise ratio of the decision variable reaches a peak value;
- wherein the AGMF weight determination module monitors two consecutive states of the decision variable in order to determine when the signal-to-noise ratio of the decision variable is at the peak value;
- wherein the AGMF weight determination module simultaneously generates a first $\vec{w}(q)$ and a second $\vec{w}(q')$ vector of weight signals, each vector of weight signals

corresponding respectively to one of the two consecutive states of the decision variable, and wherein the rake receiver comprises:

a plurality of correlator fingers that receive the spread spectrum input signal and apply a despreading signal to generate a plurality of correlation output signals;

a first output stage that applies the first vector of weight signals to the plurality of correlation output signals and generates a first consecutive state of the decision variable; and

a second output stage that applies the second vector of weight signals to the plurality of correlation output signals and generates a second consecutive state of the decision variable.

7. The AGMF rake receiver system of claim 5, wherein:

the vector of delay elements (\vec{d}) is also coupled to the AGMF weight determination module;

the CDMA processing module also generates a vector of channel impulse response signals (\vec{h}) that are coupled to the AGMF weight determination module; and

the vector of channel impulse response signals (\vec{h}) , the vector of delay elements (\vec{d}) and the signal-to-noise ratio of the first consecutive state of the decision variable are used by the AGMF weight determination module to calculate a first total noise covariance matrix (Ru_1) , and wherein the first vector of weight signals

$(\vec{w}(q))$ is calculated using the equation $\vec{w}(q) = Ru_1^{-1} \vec{h}$; and

the vector of channel impulse response signals (\vec{h}) , the vector of delay elements (\vec{d}) and the signal-to-noise ratio of the second consecutive state of the decision variable are used by the AGMF weight determination module to calculate a second total noise covariance matrix (Ru_2) , and wherein the second vector of weight signals $(\vec{w}(q'))$ is calculated using the equation $\vec{w}(q') = Ru_2^{-1} \vec{h}$.

8. The AGMF rake receiver system of claim 7, wherein the total noise covariance matrixes (Ru) each have an independent noise component and a dependent noise component.

9. The AGMF rake receiver system of claim 8, wherein the independent noise component of the total noise covariance matrixes ~~(R_u)~~ is are stored in a memory device and retrieved by the AGMF weight determination module.
10. The AGMF rake receiver system of claim 8, wherein the dependent noise component of the total noise covariance matrixes ~~(\tilde{R}_u)~~ is are calculated by the AGMF weight determination module using the vector of delay elements (\vec{d}) and the vector of channel impulse response signals (\vec{h}) .
11. (CANCELLED) The AGMF rake receiver system of claim 8, wherein the independent noise component is an independent noise covariance matrix ~~(R_{IND})~~ and the dependent noise component is a dependent noise covariance matrix ~~(R_{DEP})~~ , and the total noise covariance matrix is calculated using the formula $R_u = r_o R_{MUI} + (1 - r_o) R_{IAN}$, wherein the value of r_o is varied between $0 \leq r_o \leq 1$ by the AGMF weight determination module in order to vary the vector of weight signals ~~(\vec{w})~~ until the signal-to-noise ratio of the decision variable reaches a peak value.
12. (CANCELLED) The AGMF rake receiver system of claim 11, wherein the value of r_o is represented by a plurality of discrete states.
13. The AGMF rake receiver system of claim 1, wherein the rake receiver comprises:
a plurality of correlator fingers that receive the spread spectrum input signal and apply a despreading signal to generate a plurality of correlation output signals;
a first plurality of weight multipliers, each of which is coupled to one correlation output signal and one weight signal from the first vector of weight signals $(\vec{w}(q))$ ~~(\vec{w})~~ and generates a weight multiplier output; and
an first adder coupled to the weight multiplier outputs from the plurality of weight multipliers that combines the plurality of weight multiplier outputs from the first plurality of weight multipliers to generate the a first consecutive decision variable
a second plurality of weight multipliers, each of which is coupled to one correlation output signal and one weight signal from the second vector of weight signals $(\vec{w}(q'))$ and generates a weight multiplier output; and

a second adder that combines the plurality of weight multiplier outputs from the second plurality of weight multipliers to generate a second consecutive decision variable.

16. (CANCELLED) The AGMF rake receiver system of claim 1, wherein:

the first output stage comprises:

a first plurality of weight multipliers, each of which is coupled to one weight signal from the first vector of weight signals and generates a first weight multiplier output, and

a first adder coupled to the first weight multiplier outputs from the first plurality of weight multipliers that combines the first weight multiplier outputs to generate the first state of the decision variable; and

the second output stage comprises:

a second plurality of weight multipliers, each of which is coupled to one weight signal from the second vector of weight signals and generates a second weight multiplier output, and

a second adder coupled to the second weight multiplier outputs from the second plurality of weight multipliers that combines the second weight multiplier outputs to generate the second state of the decision variable.

21. A method of optimizing a signal-to-noise ratio in a decision variable output of an Adaptive Generalized Matched Filter (AGMF) rake receiver system, comprising the steps of:

providing a rake receiver that applies a vector of weight signals (\vec{w}) to a spread spectrum input signal to compensate for multi-user interference and generates a decision variable output;

providing a Code Division Multiple Access (CDMA) processing module that monitors the decision variable output and generates the vector of weight signals as a function of a scalar parameter (r_0);

setting the scalar parameter to a first value;

generating the a first vector of weight signals $(\vec{w}(q))$ using the first scalar parameter value;

generating a first a decision variable output using the CDMA processing module according to the first vector of weight signals $(\vec{w}(q))$;

calculating a first signal-to-noise ratio of the first decision variable output;

setting the scalar parameter to a second value;
generating the a second vector of weight signals $(\bar{w}(q'))$ using the second scalar parameter value;
generating a second decision variable output using the CDMA processing module according to the second vector of weight signals $(\bar{w}(q'))$;
calculating a second signal-to-noise ratio of the second decision variable output;
and
if the second signal-to-noise ratio is greater than the first signal-to-noise ratio, then setting the first scalar parameter value to the second scalar parameter value.

22. A method of determining a vector of weight signals (\bar{w}) for optimizing a spread spectrum signal rake receiver in a mobile communication device, comprising the steps of:

receiving a spread spectrum signal;
determining a vector of channel impulse response signals (\bar{h}) from the spread spectrum signal;
providing an independent noise covariance matrix (R_{IAN}) ~~(R_{IND})~~ stored in a memory location on the mobile communication device;
monitoring the vector of channel impulse response signals (\bar{h}) to determine a dependent noise covariance matrix (R_{MUI}) ~~(R_{DEP})~~ ;
determining a total noise covariance matrix (Ru) ~~(\bar{Ru})~~ as a function of the independent noise covariance matrix (R_{IAN}) ~~(R_{IND})~~ , the dependent noise covariance matrix (R_{MUI}) ~~(R_{DEP})~~ and a scalar parameter (r_o) ; and
determining the vector of weight signals (\bar{w}) from the total noise covariance matrix (Ru) ~~(\bar{Ru})~~ and the vector of channel impulse response signals (\bar{h}) .

23. The method of claim 22, wherein the total noise covariance matrix (Ru) ~~(\bar{Ru})~~ is calculated using the equation $R_u = r_o R_{MUI} + (1 - r_o) R_{IAN}$ ~~$R_u = r_o R_{DEP} + (1 - r_o) R_{IND}$~~ .

29. The method of claim 22, wherein the scalar parameter (r_0) is calculated using a one dimensional search algorithm that identifies an optimal value for the a feedback signal from the spread spectrum signal rake receiver.

Claims 1-10, 13, and 21-29 are renumbered respectively as claims 1-20, and the claim dependency is renumbered accordingly.

Allowable Subject Matter

3. Claims 1-10, 13, and 21-29 renumbered respectively as claims 1-20 are allowed.

4. Claims 1-10 and 13, renumbered respectively as claims 1-11 are allowable because the prior art of record does not disclose or obviate the claimed subject matter wherein the AGMF weight determination module *simultaneously generates a first and a second vector* of weight signals as claimed.

5. Claims 21-29 renumbered respectively as claims 12-20 are allowable because the prior art of record does not disclose or obviate the generation of a scalar parameter which is utilized to determine the vector of weight signals.

While the prior art of record, namely Bottomley (IDS March 2002), discloses the generation of the vector of weight signals according to a noise covariance matrix, the prior art of record does not disclose that the noise covariance matrix is used in combination with a scalar parameter to generate the vector of weight signals.

Conclusion

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6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Perilla whose telephone number is (571) 272-3055. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Vanderpuye can be reached on (571) 272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jason M. Perilla
September 27, 2005

jmp



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PRIMARY EXAMINER